Seattle-King County EMS

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CBT/OTEP 450

Diabetic Emergencies

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www.emsonline.net

Diabetic Emergencies

Introduction

Diabetes affects an estimated 20.8 million people in the United States alone. That's 7% of the population. The rise in the rate of diabetes has been called a diabetes epidemic by the Centers for Diseases Control and Prevention (CDC).

Diabetes by definition is when the body does not produce or properly use insulin. The cause of diabetes continues to be a mystery. However, both genetics and environmental factors such as obesity and lack of exercise appear to play roles. At least 1/3 of people with diabetes are unaware they have the disease.

Complications of diabetes include kidney failure, blindness, heart disease, stroke and lower extremity amputations. While diabetes can strike anyone, those at higher risk are certain racial and ethnic groups including African Americans, American Indian/Native Alaskans, Asian, Pacific Islander and Hispanic/Latino communities.

Before You Begin

This is a continuing education and recertification course for EMTs. It covers fundamental EMT-Basic concepts and terminology as well as advanced material. We highly recommend completing the case studies and practice exam before completing the exam. We also recommend that you review an EMT textbook chapter covering diabetic emergencies as a refresher before taking the exam; for example: Chapter 15 in *Emergency Care and Transportation of the Sick and Injured*, 9th edition (AAOS) or Chapter 19 in *Emergency Care*, 10th edition (Brady).

Practical Skills

To receive CBT or OTEP credit for this course a trained skills evaluator must evaluate your ability to perform hands-on practical skills including the following:

- indicate the need for ALS and/or immediate transport (SICK)
- perform blood glucometry and record findings
- provide oral glucose (if indicated) and perform proper "after-care" instructions

Go to the Downloads section of EMS Online to download the Skills Checklist for this course (click "2006 CBT/OTEP Skills Checklists").

Course Objectives

After completing this module on diabetes you will be able to:

1. Identify the purpose of glucose and insulin.
2. Identify the characteristics of Type 1 and Type 2 diabetes.
3. Identify causes of hypo- and hyperglycemia and distinguish between them.
4. Identify the signs/symptoms of DKA.
5. Identify key principles in the assessment of a diabetic emergency patient.
6. Identify the statement that best explains the relationship between altered mental status and airway management.
7. Identify 2 current methods used to treat diabetes.
8. Identify the key steps in the care of a diabetic emergency patient.

Diabetic Emergencies

Terms

Terms You Should Know

diabetic coma — An unconscious state caused by high blood glucose. Dehydration and acidosis are associated symptoms.

diabetes — A metabolic disorder in which the ability to metabolize carbohydrates is impaired, usually because of a lack of insulin or interference with the effects of insulin.

diabetic ketoacidosis — A condition resulting from diabetes characterized by hyperglycemia and acidosis.

glucose — one of the basic sugars; the primary fuel, with O2, for cellular metabolism.

hyperglycemia — Excess concentration of glucose in the blood.

hypoglycemia — Deficient level of glucose in the blood.

insulin — A hormone produced by the pancreas that enables sugar in the blood to enter the cells of the body; it is used in synthetic form to treat and control diabetes.

ketoacidosis — A condition resulting from metabolism of fatty acids.

Kussmaul respirations — Deep, rapid breathing; usually the result of an accumulation of certain acids when insulin is not available in the body.

Type 1 diabetes — A type of diabetes that usually starts in childhood and requires insulin injections for treatment. Previously referred to as "juvenile diabetes."

Type 2 diabetes — A type of diabetes that usually starts in later life and often can be controlled through diet and oral medications. Previously referred to as "adult onset diabetes."

New Terms

hyperosmolar nonketotic coma — A complication of Type 2 diabetes that results in extremely high glucose levels without the presence of ketones, a by-product of fat that can cause other complications.

ketones — Acids that are the product of fat metabolism.

polydipsia — Excessive thirst persisting for long periods of time despite reasonable fluid intake; often the result of excessive urination.

polyphagia — Excessive eating; in diabetes, the inability to use glucose properly can cause a sense of hunger.

polyuria — The passage of an unusually large volume of urine in a given period.

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Resources

American Diabetes Association
http://www.diabetes.org

American Association of Diabetes Educators
http://www.aadenet.org/

Diabetic Emergencies

Glucose

Your body's cells need glucose (or sugar) to function properly. Glucose is your body's major source of energy; without it, brain cells rapidly suffer permanent damage.

Food is digested by the body into three main nutrients:

- fats
- carbohydrates
- proteins

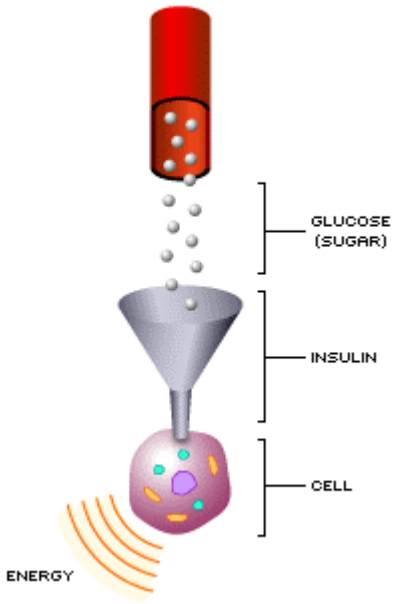
Glucose is a simple carbohydrate and the first to be absorbed into the blood.

Diabetic Emergencies

Insulin

Glucose is essential for all cells, especially for brain cells.

In a healthy person, rising blood glucose levels stimulate the pancreas to secrete insulin. Insulin acts like a funnel that directs glucose into the cells.



Healthy glucose production

Insulin helps glucose enter the cells and produce energy.

For patients diagnosed with diabetes, insulin has to be given as an injection. Most diabetics are familiar with needles and may give themselves the injections.

Important: Take extra precaution to avoid being stuck by a diabetic's syringe, especially with an unconscious patient, or one having a seizure.

See the Infectious Diseases course for a short video on the dangers of an accidental needle-stick.

Insulin pumps

Insulin pumps deliver rapid- or short-acting insulin 24 hours a day through a catheter placed under the skin. People of all ages with Type 1 diabetes use insulin pumps and people with Type 2 diabetes have started to use them as well.

Oral medications

There are now several medications available to help treat diabetes. Most are taken in pill form. Become familiar with the name and effects of these types of medication so that you can recognize them during a SAMPLE history.

They include:

- Sulfonylureas. Stimulate your pancreas to make more insulin.
- Biguanides. Decrease the amount of glucose made by your liver.
- Alpha-glucosidase inhibitors. Slow the absorption of the starches you eat.
- Thiazolidinediones. Make you more sensitive to insulin.
- Meglitinides. Stimulate your pancreas to make more insulin.
- D-phenylalanine derivatives. Help your pancreas make more insulin quickly.

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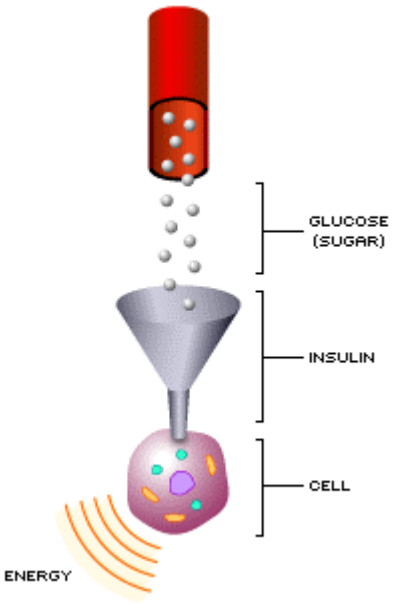
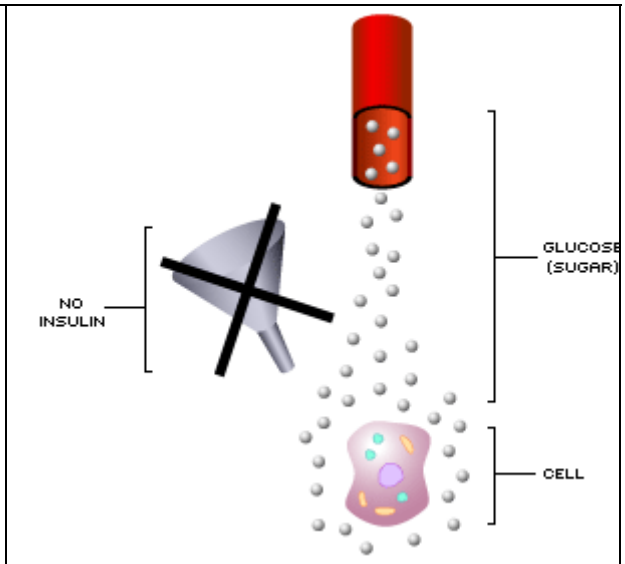
Type 1

Glucose is the basic fuel for the cells in the body. Insulin allows glucose from the blood to enter the cells.

In type 1 diabetes, the body does not produce insulin.



Healthy Person



Type 1 Diabetic

If diabetes is left untreated or undiagnosed, glucose levels rise because the cells cannot absorb the circulating glucose without insulin.

This causes the Three Ps:

- polydipsia (constant thirst)
- polyuria (excessive urination)
- polyphagia (ravenous appetite)

More information on the Three Ps

A common set of symptoms that are considered hallmark signs in recognizing untreated type 1 diabetes is the Three P's of Diabetes. They are:

- polydipsia, an excessive thirst persisting for long periods of time despite reasonable fluid intake;
- polyuria, which is the passage of an unusually large volume of urine; and
- polyphagia, which is excessive eating.

Without insulin, a diabetic's blood sugar (glucose) rises to a high level which damages both small and large blood vessels. If the small vessels stop working, the nerves they supply die, leading to loss of sensation and other types of neuropathies.

This is why diabetics run the risk for ‘silent' heart attacks, retinal destruction, renal destruction and other nerve-related problems. For long term patients, it is not uncommon to see distal amputations due to decreased perfusion to the extremities.

The body's cells report to the brain that they are not receiving sugar even though sugar is abundant outside the cells. The sugar cannot get in because of the lack of insulin. To fix the problem, the brain demands more food, resulting in polyphagia. At the same time the brain instructs the body to go into an alternative method of energy production by breaking down stored fats. This process produces a build up of ketones—a by product of fat metabolism.

The body attempts to solve this problem by flushing ketones out through frequent urination — polyuria. This leads to excessive thirst — polydipsia. Other symptoms of this progressive process are weakness, altered mental status (from lethargy to unconsciousness), rapid respirations (caused by the body trying to expel ketones), and occasionally a fruity breath odor (from the ketones).

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Type 2

In type 2 diabetes, either the body does not produce enough insulin or the cells ignore the insulin that is being produced. Type 2 diabetes is the most common form of diabetes accounting for nearly 90 percent of all cases.

Type 2 diabetes can be controlled by diet and exercise, oral medication or insulin. The **oral medications** prescribed for this type of diabetes stimulate the pancreas to produce more insulin. Some type 2 diabetics must use injected insulin.

Gestational Diabetes

Gestational diabetes is a type of diabetes that begins during pregnancy. It usually becomes apparent in the 24th to 28th weeks of pregnancy. In many cases, the blood glucose level returns to normal after delivery.

The symptoms are usually mild and not life-threatening to the pregnant woman. However, the increased maternal glucose levels are associated with larger birth weight and an increased rate of prenatal complications, including birth trauma, hypoglycemia and jaundice. Rarely, late intrauterine fetal death occurs.

Maintaining control of blood glucose levels significantly reduces the risk to the offspring. This can be done with diet and exercise, but may require insulin use in severe cases.

The risk factors for gestational diabetes are:

- maternal age of more than 25
- family history of diabetes
- obesity
- previous birth of an 9 pound or larger baby
- unexplained death of a previous infant or newborn

The complications of type 1 and type 2 diabetes include:

- kidney failure
- blindness
- heart disease
- stroke
- lower extremity amputations

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Hypoglycemia

What oxygen is to the body, sugar is to the brain: there must be a constant supply at all times. Hypoglycemia is a true life-threatening emergency because there is no glucose to nourish brain cells. Imagine having to hold your breath for 6 minutes. Without sugar to the brain, unconsciousness may occur and permanent brain damage can quickly follow.

A diabetic must carefully maintain his or her blood glucose levels by balancing insulin, diet and exercise. However, hypoglycemia (sometimes called insulin reaction) can happen even when a person is doing all he or she can to manage their diabetes.

Hypoglycemia occurs as a result of:

- too much insulin--accidental or intentional
- low food intake
- too much exercise

Signs and symptoms of hypoglycemia can develop quickly over a period of minutes and may include:

- cold, pale, clammy skin
- abnormal or hostile, bizarre behavior; patient may appear intoxicated
- shaking, trembling, weakness
- full, rapid pulse
- normal or elevated blood pressure
- normal or rapid respirations
- dizziness, headache, blurred vision
- extreme hunger
- slurred speech
- seizures, loss of consciousness

Most of the diabetics in crisis that BLS providers encounter present with hypoglycemia.

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Hyperglycemia

In hyperglycemia, the pancreas does not produce enough insulin, or doesn't effectively use the available insulin produced.

Hyperglycemia occurs as a result of:

- Too little insulin (e.g. diabetic doesn't take enough)
- Not enough exercise
- Too much food

Symptoms of hyperglycemia include:

- Kussmaul respirations
- Weak, rapid pulse (possibly irregular)
- Warm dry skin
- Normal to profoundly decreased blood pressure
- Fruity odor on breath
- Nausea, vomiting, or abdominal pain
- Altered LOC

In the presence of hyperglycemia, cells use other foods for energy, particularly fats. When the body metabolizes fats, ketones are produced and the blood becomes very concentrated. The kidneys respond by excreting glucose and ketones.

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DKA

Diabetic ketoacidosis (DKA) is a condition when your body is burning fat instead of sugar. It is a serious condition that can lead to diabetic coma, or even death. It is more common in people with type 1 diabetes.

Ketoacidosis usually develops slowly. However, if vomiting occurs, this life-threatening condition can develop in a few hours. The first symptoms are:

- frequent urination, dehydration and extreme thirst (the Three P's)
- high blood glucose levels
- high levels of ketones in the urine
- fruity breath from blowing out ketones

Ketones are acids that build up in the blood. They appear in the urine when the body doesn't have enough insulin. Ketones can poison the body by changing the pH balance.

More information on DKA

It is common in DKA for the patient to have high blood sugar, severe dehydration, rapid respiratory rates, altered mental status, a significant alternation of the body's blood chemistry and sometimes a distinctive fruity odor on the breath. The most common events that cause DKA are:

- Infection (40%)
- Missed insulin (25%)
- Newly diagnosed or previously unknown diabetes (15%)
- Heart attack, stroke, trauma, stress, and surgery (10%)

20% of the time there is no identifiable cause.

Ketoacidosis occurs rarely in people with type 2 diabetes. But some people -- especially older people -- with type 2 diabetes may experience a different serious condition called hyperosmolar nonketotic coma.

Diabetic coma is a state of unconsciousness resulting from several problems including:

- hyperglycemia
- ketoacidosis
- profound dehydration

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Assessment

The first step is to quickly determine the nature of illness—is the patient SICK or NOT SICK.

The most effective way to determine if it is a diabetic emergency is to obtain a glucose reading from a glucometer. A low reading of 50 mg/dl for example, may indicate hypoglycemia—a high reading of 400 mg/dl may indicate hyperglycemia.

Key questions in the assessment of a conscious diabetic patient include:

- When did you eat last?
- Have you taken your insulin or medication today?
- Has there been a change in your health, stress level, or exercise?
- When did the symptoms begin?

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LOC

An altered level of consciousness is a common symptom of a diabetic emergency. An altered LOC is also a possibility for someone who may be having a stroke, is drunk or has a head injury. From the moment of dispatch, keep an open mind about the potential causes of a chief compliant.

The diabetic with severe low blood sugar may die if not treated. When examining someone who appears drunk, don't just assume he or she has been drinking alcohol; always ask to confirm. Be prepared to treat the symptoms you observe without having to diagnose the condition first.

Untreated hypoglycemia will result in loss of consciousness and can quickly cause significant brain damage or death. Establish an airway, be prepared to assist with ventilations and get ready for transport or the arrival of ALS.

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Airway

Unconscious patients are at risk of losing their gag reflex. When the reflex is not working, a person cannot reject foreign materials like vomit. In addition the tongue can relax and block the airway.

Vomit contains hydrochloric acid that can damage the lungs tissues and produce pneumonia.

Airway management includes:

- Appropriate positioning
- Maintaining the airway
- Have suction device ready
- High flow oxygen with appropriate device
- Assisting ventilations as needed

Diabetic Emergencies

Treatment

Hypoglycemia is the most common diabetic emergency. A patient with hypoglycemia needs sugar immediately. They often respond quickly after eating or drinking sugary foods that contain fast acting carbohydrates such as fruit juice, jelly beans or honey.

The key principles of treatment for a diabetic episode include:

- take necessary BSI precautions
- request medics if indicated—determine SICK or NOT SICK
- perform glucose check
- position upright and give oral glucose (if gag reflex is present)
- monitor vital signs and LOC
- document times and levels of glucose checks

Because some patients respond quickly to a sugar drink or glucose, they may not see the need to be evaluated at the hospital. Be familiar with your department's guidelines on leaving a diabetic patient at home.

King County Patient Care Guidelines

Patients on insulin may be safely left at home in the following circumstances:

1. **Responds completely*, AND**
2. **Able to eat and drink normally, AND**
3. **Someone can remain with them.**

*Responds completely is defined as having a blood glucose level greater than 60.

King County After Care Instructions

The After Care instructions form is updated and available in the Downloads section of EMS Online.

A patient in a diabetic coma needs insulin and IV fluid therapy. These patients respond gradually within 6-12 hours of medical treatment.

Diabetic Emergencies

Summary

The following key points were covered in this module:

Diabetes is a disease that refers to a body's **inability to produce insulin**, or use insulin effectively.

Diabetics must balance their **medications, food intake,** and **activity level**. Diabetic emergencies can occur when any of these elements are out of balance.

Type 1 diabetics do not produce insulin, and **type 2** diabetics produce inadequate amounts, or don't effectively use what they do produce.

Glucometry is the best way to determine whether a patient is **hypoglycemic** or **hyperglycemic**. The speed of onset, skin signs, and quality of respirations are other clinical indicators.

The signs and symptoms of a diabetic emergency include an **altered level of consciousness**.

Maintain a high index of suspicion for **patients who appear intoxicated**, or show signs of a head injury.

Treatment includes **maintaining the airway, providing oral glucose** and seeking **advanced medical treatment**.